the *Eastern Star*, published at Grahamstown, Cape Colony, in which Mr. L. A. Eddie, F.R.A.S., draws attention to the duplication of the nucleus which appears to have been first remarked at the Royal Observatory, Cape of Good Hope, on September 30, and on the same date in the United States: a day or so later European observers very generally perceived it. On the morning of September 24, at 4h. 30m., Mr. Eddie, says: "A most glorious sight presented itself. The head of the comet had not yet risen, but a broad belt of golden light, about two degrees in breadth, streamed upwards from the horizon to about ten degrees; and from the northern margin of this again, a thin streak of less brilliant light extended upwards to about another twelve degrees, and when the head had fully risen above the horizon at 4h. 43m. a.m., there were about twenty-five degrees in length of intensely luminous matter, stretching upwards from a still more luminous head, and inclined to the horizon at an angle of 70°. . . . The head appeared as before, to consist of an apparently very solid though not very large nucleus, surrounded by a dense coma of no great extent, especially preceding the nucleus, and possessing no dark intervals, &c." The weather prevented further observation at Grahamstown till the morning of October 3, when, on directing his 9½-inch Calver upon the nucleus, Mr. Eddie saw not one round planetary disc, as he had last seen it, but "two distinct ellipsoidal nuclei in juxtaposition, each of them brighter on the interior edge, and drawn out, as it were, towards the comet's ulterior boundary, so that their conjugate axes were about double the transverse. They closely resembled, in the inverting telescope, the flames of two candles placed the one above the other, so that the uppermost part of the lower flame almost overlapped the lower portion of the other. There was a dark rift the breadth of the transverse axes of these nuclei, extending from the hindermost one into the tail. These two nuclei were not parallel with the axis of the comet, but the foremost was drawn, as it were, to the south, or nearer to the direction in which the comet is moving." Mr. Eddie further compares the two nuclei to the double-star α Centauri when viewed through a cloud with a low power. When daylight had advanced, they could be seen in the telescope perfectly free from the light of the surrounding coma. On the following morning the nuclei were distinctly divided with powers of 60 and 100 on the reflector: the preceding nucleus was larger and brighter than the other, but both were, if anything, smaller than previously.

The *Natal Mercury* of October 6 describes the imposing spectacle which the comet presented as it rose apparently from the Indian Ocean. The nucleus shone with a brilliancy rivalling Sirius, or even Venus, and the tail was slightly curved, and though, as dawn approached, a little diminished in length, appeared more concentrated and magnificent.

Observers who remember the great comet of 1843, as it presented itself in the southern hemisphere, are somewhat divided in opinion as to which body to give the palm on the score of brilliancy, though most of them appear inclined to favour the former. The Emperor of Brazil, who observed the comet of 1843 close to the sun on February 28, and on the following evenings, considers it was not so remarkable for the brightness of the nucleus as the present comet, but that the tail had a much greater extent.

At Santiago, Chile, the comet was visible on September 17, some minutes before sunrise, and on the next morning could be followed until 11h. 30m. with the greatest facility without the telescope; part of the tail near the nucleus was also visible, the northern border being much brighter than the other. On September 20, though the light of the comet had somewhat diminished, it was seen with the naked eye till 10h. 30m. M. Niesten, Chief of the Belgian expedition for the observation of the transit of Venus, observed the comet in Chile: he found the length of the tail (northern branch) 25° on September 22, and 22° on the following morning.

By the kindness of the Astronomer Royal, we learn that the comet was observed on the meridian at Melbourne on September 15, 16, and 17 civil reckoning; equatorial observations commenced on the morning of September 10: Mr. John Tebbutt observed the comet the previous morning at his private observatory, Windsor, N.S.W. The Melbourne meridian observations will be of great value in the determination of the elements of the orbit prior to the comet's rush through the solar coronal region, the last one having been made only fifteen hours before the perihelion passage.

Subjoined is an ephemeris of the comet for 18h. M.T. at Greenwich. It will be seen that it is now well observable on the meridian.

	Right Ascension.	Declination.	Distance from Earth.	Sun.
	h. m. s.	°		
Nov. 16	9 25 58	−25 3·1	1·496	1·688
18	9 21 25	25 39·0		
20	9 16 40	26 13·5	1·500	1·762
22	9 11 43	26 46·4		
24	9 6 35	27 17·6	1·510	1·835
26	9 1 16	27 46·9		
28	8 55 47	−28 14·2	1·514	1·906

The latest investigations on the motion of this comet tend to indicate, contrary to the expectation that was at first entertained by many astronomers, that it is not identical either with the great comet of 1843, nor with that which appeared with so great a resemblance in the elements of the orbit in 1880. Calculations by Messrs. Chandler, Wendell, and Hind, are so far in accord upon this point.

RECENT DYNAMO-ELECTRIC MACHINES

ELECTRICAL inventions of innumerable kinds have of late followed one another with bewildering rapidity; and the impetus to invention afforded by the present development of electric lighting, and by recent electrical exhibitions, is making itself felt in many ways. Most important, perhaps, of these is the production of improved types of machines for generating electric currents. Dynamo-electric machines, in fact, appear to be undergoing the same kind of evolution which the steam-engine has undergone; and just at present the tendency appears to be in the direction of producing larger and heavier machines than heretofore.

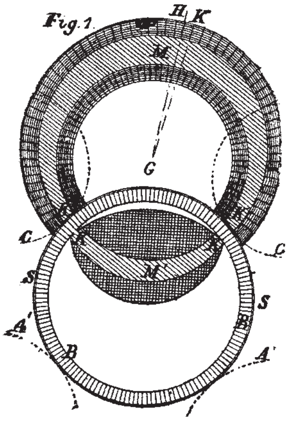
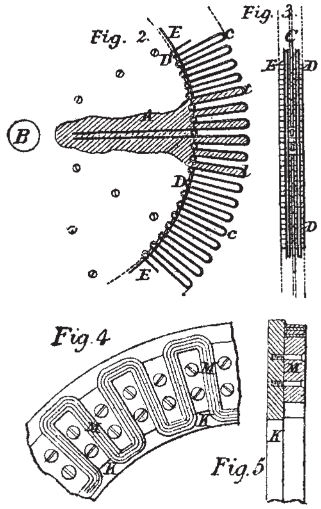


FIG. 1.—Sir W. Thomson's Roller Dynamo.

The readers of NATURE will be familiar with the description of Edison's large steam-dynamo, which first made its appearance in Paris in 1881, and of which two examples are now at work in the Edison installation at Holborn Viaduct. These monster dynamos, each requiring from 120 to 150 horse-power to drive it, are capable of lighting from 1000 to 1300 incandescent electric lamps.



FIGS. 2–5.—Sir W. Thomson's Disk-Dynamo

Six such machines have been also erected in New York to supply the central station of the Edison Light Company. Here the unexpected difficulty has arisen that if one of the machines drops in speed the currents from the other machines short-circuit themselves through the one, and overpower the steam-engine that is driving it; a fault which will probably be remedied by a rearrangement of the governors supplying the steam to the engines.

New forms of dynamo-electric machine have been designed by Sir William Thomson, some of these being for direct currents, others for alternate, but all of them of peculiar construction. The first of them, shown in Fig. 1, may be described as a modification of Siemens' well-known machine, the drum-armature being, however, made up like a hollow barrel, of which B B is a sectional view, the separate staves being copper conductors insulated from one another. They resemble the longitudinal bars used by Siemens in the armatures of his electro-plating machines, and by Edison in his steam-dynamo. At one end of the hollow drum these copper bars are united to each other in pairs, each to the one opposite it. At the other end their prolongations serve as commutator bars. A similar mode of connecting to that adopted by Edison, is also possible. Inside this hollow drum armature is an internal stationary electro-magnet, K M′ K, whose poles face those of the external field magnets. This internal magnet answers the purpose of intensifying the magnetic field, and making the magnetic system a "closed" one, as suggested long before by Lord Elphinstone and Mr. Vincent. This hollow armature Sir W. Thomson proposes to support on external antifriction rollers A A′ C C′, the lower pair A A being of non-conducting material, the upper pair being made up of conical cups of copper split radially, and serving, instead of the usual commutator "brushes" to lead away the current. The hollow armature may be driven either by the tangential force of one of the bearing rollers, or by an axle fixed into the closed end of it.

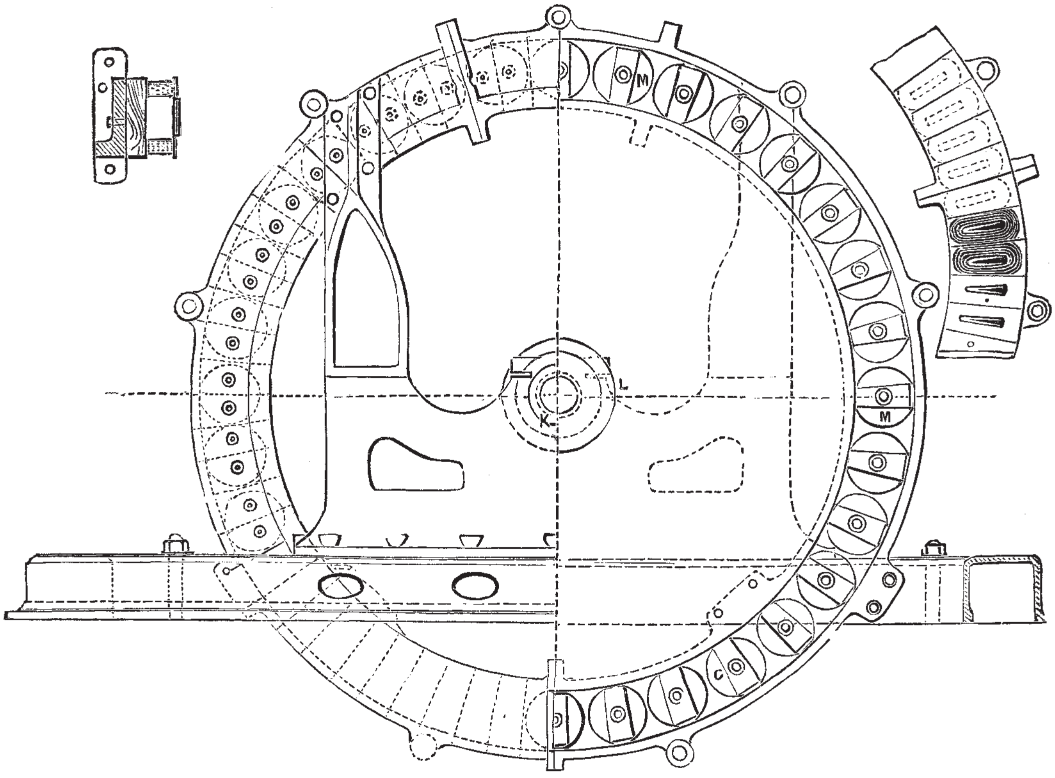


FIG. 6.—Elevation of Gordon's Dynamo, showing the rotating coils. The "taking-off" coils are shown in the top right hand corner.

Another machine devised by Sir W. Thomson, and illustrated in Figs. 2, 3, 4, and 5, is a disk-dynamo for generating alternate currents, and is therefore allied in certain aspects to Mr. Gordon's machine, described below. The rotating armature has no iron in it; it consists of a disk of wood having upon its sides projecting wooden teeth, as shown in Figs. 2 and 3, between which a wire or strip of copper is bent backwards and forwards, and finally carried to the axle B. This disk is rotated between field-magnets having poles set alternately all round a circular frame. Figs. 4 and 5 show how this is carried out. A cast-iron ring having projecting iron pieces screwed into it is surrounded by zig-zag conductors which carry into it the current from a separate exciter. These currents pass up and down between the projecting cheeks, and excite those on both sides of them.

A still more recent, and still larger generator, is that designed by Mr. J. E. H. Gordon, whose "Physical Treatise on Electricity and Magnetism" is known to most of our readers. This machine, which is given in elevation in Fig. 6, and in end-elevation in Fig. 7, is more than 9 feet in height, and weighs 18 tons. It possesses several points of interest. The rotating armature differs from those of the well-known Gramme or Siemens' armatures, being in form a *disc*, constructed of boiler-plate, upon which the coils are carried. The machine, therefore, resembles in some respects the Siemens' alternate-current machine, though there are notable points of difference, the most important being, that whereas in most dynamo-machines the inducing field-magnets are fixed, and the induced coils rotating, in Mr. Gordon's new machine the rotating coils are those which act inductively upon the fixed coils between which they revolve. The machine furnishes alternate currents, and therefore requires separate exciters. These exciters, two Bürgin machines, send currents which enter and leave the revolving armature by brushes pressing upon rings of phosphor bronze placed upon the axis at either side. There are 64 coils upon the rotating disc, and double that number upon the fixed framework. These 128 "taking-off" coils, the form of which is shown in Fig. 8, are alternately connected to two circuits, there being 32 groups in parallel arc, each parallel containing 4 coils in series; thus bringing the total electromotive force to 105 volts when the machine is driven at 140 revolutions per minute. At this speed it actuates 1300 Swan lamps, but is calculated to actuate from 5000 to 7000 if the driving power is proportionately increased. The machine is now in operation at the Telegraph Construction and Maintenance Company's Works, East Greenwich.

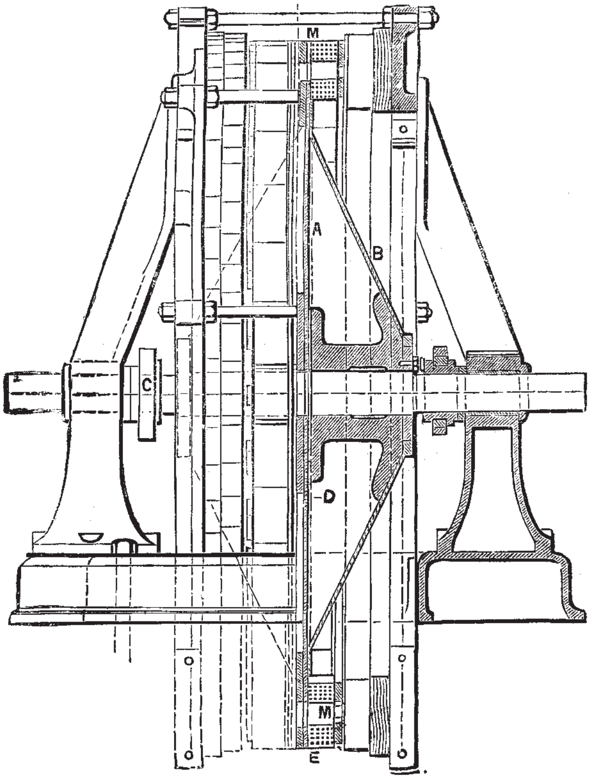


FIG. 7.—End Elevation and Section of Gordon's Dynamo.

A great deal has been said in certain quarters of late about another new dynamo, the invention of Mr. Ferranti, which, with one of those unscientific exaggerations which cannot be too strongly condemned, was pronounced to have an efficiency five times as great as that of existing dynamos. The construction of this machine has not yet been made known, but it is understood that it has no iron in the rotating armature. This is, however, no novelty in dynamos. It appears, also, that Mr. Ferranti has invented an alternate-current machine almost identical with that of Sir William Thomson described above.

Lastly, M. Gravier claims to have designed a form of dynamo in which there are neither commutators nor separate exciters, but in which continuous currents of electricity are produced in stationary coils by the passage near them of a rotating series of iron bars whose magnetism is changed, during their passage, by the reaction of the cores of the stationary coils themselves. M. Gravier has also designed a machine in which a Gramme-ring is wound with two sets of coils, a primary and a secondary, each set having its own commutator on opposite ends of the axis. A current from a separate exciting machine passes into the primary coils of the ring by one pair of brushes, and the secondary current is taken off by a second pair of brushes at the other commutator placed at right angles to the first pair. We are not aware that any practical machine thus constructed has yet been shown in action.

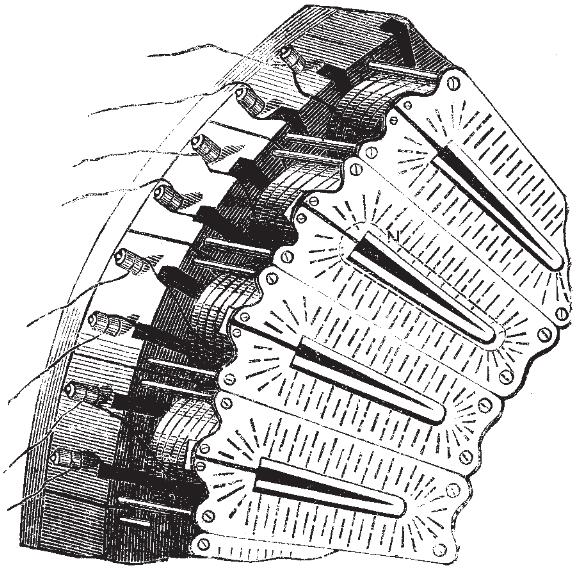


FIG. 8.—The Fixed Coils of Gordon's Dynamo.

It is certain that there is yet abundant room for great improvement in the construction of dynamo-electric machines. But the inducements to improvement at the present time are so great that rapid progress toward the desired goal of perfect efficiency and simplicity of structure is more than assured.

THE PROJECTION PRAXINOSCOPE

M. GASTON TISSANDIER describes in *La Nature* an ingenious adaptation of the praxinoscope, under the above name, by means of which the images are projected on a screen, and are visible to a large assembly.